



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

# Meeting its Waterloo? Recycling in entrepreneurial ecosystems after anchor firm collapse

### Citation for published version:

Spigel, B & Vinodrai, T 2020, 'Meeting its Waterloo? Recycling in entrepreneurial ecosystems after anchor firm collapse', *Entrepreneurship and Regional Development*, vol. N/A, pp. 1-23.  
<https://doi.org/10.1080/08985626.2020.1734262>

### Digital Object Identifier (DOI):

[10.1080/08985626.2020.1734262](https://doi.org/10.1080/08985626.2020.1734262)

### Link:

[Link to publication record in Edinburgh Research Explorer](#)

### Document Version:

Peer reviewed version

### Published In:

Entrepreneurship and Regional Development

### Publisher Rights Statement:

This is an Accepted Manuscript of an article published by Taylor & Francis in Entrepreneurship & Regional Development on 2/3/2020, available online:  
<https://www.tandfonline.com/doi/full/10.1080/08985626.2020.1734262>.

### General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

### Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



# **Meeting its Waterloo? Recycling in Entrepreneurial Ecosystems after Anchor Firm Collapse**

Ben Spigel  
University of Edinburgh Business School  
ben.spigel@ed.ac.uk

Tara Vinodrai  
University of Toronto  
tara.vinodrai@utoronto.ca

## **Abstract**

The ‘recycling’ of people, capital, and ideas within an entrepreneurial ecosystem is one of the key processes driving its support for further high-growth entrepreneurship. Skilled workers who leave firms after successful exits or firm collapse bring with them new knowledge and insights that they can use to start their own new ventures or work at existing scale-up firms. This makes large anchor firms important actors in attracting workers to the region who may subsequently recycle into the ecosystem. However, there is limited empirical research on recycling into an ecosystem after the loss of an anchor firm. This paper develops a novel methodology to gather career history data on the employees to track rates of recycling into ecosystems. The paper develops a study of Waterloo, Ontario, home to the smartphone manufacturer Blackberry, whose decline in 2008 represented a significant shock to the local entrepreneurial ecosystem. We find that alumni of this firm engaged in very little high-growth entrepreneurship themselves, but many employees entered the ecosystem as technology employees at high-growth scale-up firms. This was aided by the increasing institutional capacity of the region to match skilled workers with new ventures, helping ensure the continued success of the ecosystem over time. These findings allow for a more nuanced understanding of the role of anchor firms in entrepreneurial ecosystems and how recycling affects the dynamics of entrepreneurial ecosystems.

The authors are grateful for the helpful comments made by the editors and three anonymous reviewers, as well as feedback on previous versions of this paper presented at conferences and the Creating Digital Opportunities Partnership annual meetings. We thank John Barber, Martin Holicka and Ondrej Bohdal for research assistance. We would like to acknowledge financial support from Social Sciences and Humanities Research Council of Canada and the University of Waterloo. This paper represents the equal contributions of the authors. Any errors and omissions remain the responsibility of the authors.

## 1. Introduction

Entrepreneurial recycling is the flow of resources such as skilled workers, capital, and ideas from successful or unsuccessful firms into the surrounding region (Mason and Harrison, 2006). This is seen as a key process underlying the impact of ecosystems — the social, economic, cultural, and political contexts that support high-growth entrepreneurship in a region (Spigel and Harrison, 2018). Work on ecosystems has consistently emphasized the importance of highly skilled employees who can help entrepreneurs develop, build, and sell highly innovative new products and services (Malecki 2018; Stam, 2015; Mack and Mayer, 2016; Mason and Brown, 2014). The innovative potential of such workers increases the competitiveness of their employers, allowing these firms to compete in global markets for high-end products and services. This means that the ability of regions to produce, attract, and most importantly, retain highly skilled workers through recycling is a key component of building a sustainable entrepreneurial ecosystem.

Large private or public employers, commonly known as ‘anchors’, are key actors in this process. Anchors act as talent magnets, drawing in highly skilled workers by offering career opportunities and embedding these workers in the region as they establish local social and professional connections. They may subsequently recycle into the broader ecosystem as founders or employees of new, innovative start-up and scale-up firms (Bahrami and Evans 1995; Mason and Harrison 2006). Indeed, the ability of a region to recycle these workers after an economic shock such as the loss of an anchor firm has been seen as an important criterion of a region’s overall resilience (Martin and Sunley 2015). But while the migration patterns of highly skilled workers has been well studied in the literature (Kerr 2018), there is little empirical evidence about how workers who leave anchor firms recycle within their local economy. In particular, little is known about their propensity to enter the entrepreneurial ecosystem either by becoming entrepreneurs or working at local scale-up firms. This is a critical research gap as regions turn to high-growth entrepreneurship as a way to build resilient economies. The lack of sustained engagement with questions surrounding the dynamics of recycling within ecosystems represents a major research gap in the literature.

A challenge in studying intra-regional employment mobility and entrepreneurial recycling comes from the paucity of data on the workers’ career histories. Such data is difficult to come by, either generated through detailed, qualitative interviews (Vinodrai 2006) or longitudinal microdata, such as that is only available in data rich Nordic countries (Dahl and Sorenson 2012). Outside of these examples, most literature on this topic uses census data, which do not provide sufficient detail to examine the effects of local shocks such as the collapse of an anchor firm. To address this issue, we develop a novel methodology to collect data on individual career trajectories from employment-based social media sources. These data are used to explore the consequences of the decline of smartphone manufacturer Blackberry (formerly Research In Motion or RIM) on the entrepreneurial ecosystem in Waterloo (Canada), where the firm was founded and remains headquartered. Waterloo is one of North America’s strongest

entrepreneurial ecosystems due in no small part to the Blackberry's ability to attract highly skilled workers to the region and the firm's support of local entrepreneurial institutions such as university programs and local economic development organizations. The data suggest that recycling, like other ecosystem processes, are temporally dynamic, meaning that their nature and intensity changes over time in response to broader institutional developments in the region.

In this paper, we focus on entrepreneurial recycling as the transition of workers at large firms in a region to either being growth-oriented entrepreneurs or workers at a high-growth venture after a critical exit moment such as a large layoff event. In doing so, this paper makes three contributions to the growing literature on entrepreneurial ecosystems. First, it provides some of the first empirical evidence on the dynamics of entrepreneurial recycling, giving a baseline for comparison with other regions that experience exit events. Second, it explores the relationship between local institutions and recycling by showing how the recycling of skilled workers into the local ecosystem changes over time in response to local institutional developments. Finally, this paper responds to calls for using more fine-grained data sources to understand the flow of people and resources within entrepreneurial ecosystems (Feldman and Lowe 2015) by developing a novel method and dataset to track employee career trajectories within ecosystems. Both the dataset and the insights it offers on the recycling process provide new perspectives on questions about the evolution of entrepreneurial ecosystems and the foundations of regional resiliency.

The paper proceeds as follows. In the next section, we discuss the nascent literature on entrepreneurial ecosystems and recycling, connecting this with work on anchor firms and economic shocks. Following from this discussion, we provide background information and details on the case study firm (Blackberry) and region (Waterloo, Canada). We also describe the dataset employed in this paper and the methodology used to collect and process it. Section four uses this dataset to explore the recycling of tech-based talent into Waterloo's ecosystem after the decline of Blackberry. Section five contextualizes these data by showing the impact of local institutional factors on the recycling process. The paper concludes by discussing what this tells us about the dynamic processes underlying entrepreneurial ecosystems and identifies avenues for future research.

## **2. Entrepreneurial ecosystems, recycling and anchor firms**

Entrepreneurial ecosystems are a region's "actors and factors" (Stam 2015, 1765) that contribute to the increased creation and survival of high-growth new ventures. Though the term 'entrepreneurial ecosystem' dates back more than three decades (Malecki 2018), its recent ascendance can be attributed to work in the popular business sphere by Dan Isenberg (2010) and Brad Feld (2012). Both argue that a regional 'ecosystem' of entrepreneurs, investors, and public officials, in addition to a supportive local culture and dense interpersonal networks, is needed to support the ongoing creation of high-growth entrepreneurial firms. Researchers have identified several key localized resources or attributes that promote high-growth entrepreneurship. These include individuals such as ambitious entrepreneurs, knowledgeable investors, local

‘dealmakers’ with large social networks, as well as broader regional attributes like favorable public policies, strong research universities, and a culture that promotes risk-taking and collaboration (Stam and Spigel 2018; Nicotra et al. 2017). These create an environment that promotes entrepreneurial ambition and provides critical resources like financing, entrepreneurial know-how and skills required to successfully develop new products and business models, thus enabling firm growth. The presence of skilled workers has been consistently identified in the literature as a critical factor (Dubini 1989; Van de Ven 1993; Spigel 2017). Skilled workers are important for new ventures to develop innovative new products and sell them to global markets (Eckardt, Skaggs, and Lepak 2018).

While sharing similarities with previous concepts such as clusters and industrial districts, entrepreneurial ecosystem research is distinct in at least three ways. First, ecosystems maintain a specific focus on high-growth startups and scale-ups. These high-growth firms are responsible for the bulk of new job creation and regional economic growth (Brown, Mason, and Mawson 2014; Mason and Brown 2014). Definitions of high-growth firms differ, but generally refer to companies that are growing by at least 20% in terms of revenues or sales per year or have the potential to reach this state. This differs from previous entrepreneurship policy research, which instead looked at how to increase overall firm formation or self-employment rates (Autio et al. 2017). High-growth firms require different support environments than startups in lower growth areas such as retail, consumer services, or consulting, leading to the need for new policy approaches (Brown, Mawson, and Mason 2017). Entrepreneurial ecosystems research represents a new direction in the entrepreneurship policy literature due its distinct focus on this small subset of new ventures.

Second, entrepreneurial ecosystem research has emphasized the role of entrepreneurs themselves in creating a strong entrepreneurial community rather than state or other large organizational actors. Research on ecosystems has highlighted the importance of entrepreneurs as regional leaders who identify the issues that need to be addressed and create the organizations and institutions that drive changes within the ecosystem (Stam 2015). Successful entrepreneurs often emerge as ecosystem leaders, working with other stakeholders to build new organizations and institutions to support entrepreneurial endeavors (Lowe and Feldman 2017). While the ecosystem framework acknowledges entrepreneurs as critical agents, it is important to recognize that these ecosystems remain influenced by multiple actors, including governments, universities, industry associations, philanthropic groups and other local and regional actors (Hayter 2016).

Finally, entrepreneurial ecosystem research has emphasized the interconnections between different elements of a region’s entrepreneurial environment and economy (Spigel 2017). For example, a growing stream of research has pointed to the importance of interactions between entrepreneurship support programs that create a cohesive environment supporting entrepreneurial growth (Motoyama and Knowlton 2016). Entrepreneurial ecosystems are more than regions with high rates of start-up creation; they are defined by the self-reinforcing relationships between various attributes that reproduce and transform the ecosystem over time, creating durable environments and cultural outlooks that catalyze high growth entrepreneurship. Thus,

entrepreneurial ecosystems are just as much about regionally-specific institutional structures and collective beliefs about entrepreneurship as they are about particular regional policy configurations or firm structures (Roundy 2016).

Entrepreneurial ecosystems are therefore distinct from concepts such as clusters or innovation systems (Spigel and Harrison, 2018). Unlike clusters, entrepreneurial ecosystems are primarily comprised of entrepreneurial start-ups and scale-ups that are actively developing new products and entering new markets. These ventures draw on their regional economy in very different ways than larger, established firms. Entrepreneurial ventures are more dependent on local resources and are more influenced by their local contexts (Fritsch and Storey, 2014). In particular, they are much more dependent on the local labour market and other local resources because they lack the capacity to open up branch offices until late in the firm growth process (Wapshott and Mallett, 2016). More traditional cluster or innovation systems perspectives often miss how entrepreneurial firms differ in how they use and are affected by their regional context (Ylinepää 2009).

### *2.1 Recycling in entrepreneurial ecosystems*

While the entrepreneurial ecosystems concept has been critiqued for being static (Alvedalen and Boschma 2017; Auserwald and Dani 2017), previous work has explicitly examined how entrepreneurial ecosystems form and change over time (Mack and Mayer 2016; Thompson, Purdy, and Ventresca 2017). One of the key evolutionary processes of ecosystems is *recycling*: the ‘fluidity’ of resources like people, skills, knowledge, and capital that move between different firms within an ecosystem (Mason and Harrison 2006; Spigel and Harrison, 2018). Recycling occurs when the resources created or attracted by existing firms, often large corporations or local ventures that have scaled up, flow to new startups and scaleups in a region, who leverage these resources to enhance their innovation and growth potential. Such flows are often triggered by particular events, such as a successful firm exit through merger or acquisition or an unsuccessful firm exit like bankruptcy. These events reduce the opportunity costs associated with starting a new firm, encouraging entrepreneurship (Frederiksen et al. 2016). While people leaving a failing firm are often forced to due to layoffs, even a successful exit can lead to an exodus because of disagreements with new management or windfall profits from stock options.

Recycling highlights that the resources in an ecosystem are not bound to the firm that created them, but can move throughout the ecosystem. Actions like employees leaving firms to start their own firm or founders stepping back from their firms to mentor entrepreneurs or invest in other firms spread entrepreneurial resources within the ecosystem. In turn, this helps entrepreneurs access the resources they need for firm growth and enables the ecosystem to reproduce itself over time.

As illustrated in Figure 1, three types of resources can recycle back into an ecosystem after an exit event: business know-how, financial capital, and skills embodied in workers. However, it is also possible that these resources will fail to flow into the ecosystem, as talent and

capital leave the region or because people take jobs at larger, corporate employers outside of the local ecosystem. Some forms of entrepreneurial and business know-how are ephemeral and non-rivalrous, meaning that they can be provided to many different people at once. They are produced from business experience and shared through social networks and interpersonal interactions. Other resources like investment capital are more footloose, able to circulate within or leave the entrepreneurial ecosystem quickly.

But other resources are fundamentally people-based, such as workers and the skills they possess. Their networks and abilities are inseparable from themselves (Corce et al 2016). Indeed, the recycling of people is perhaps the most important form of recycling: while capital and advice can be acquired from outside the region, skilled workers are amongst the most crucial resources a firm needs in order to grow and prosper and generally must be found locally or attracted at great expense (Gjerlov-Juel and Guenther 2018; Saurmann 2017). Recycling ensures a steady pool of skilled workers that entrepreneurial ventures can draw on as well as a pool of new entrepreneurs to found new innovative ventures. Such people bring with them the skills and insights they developed in their previous jobs along with knowledge of organizational routines and market opportunities, making them particularly valuable as founders or early-stage workers (Toft-Kehler et al., 2014).

[Figure 1 here]

Former founders and workers at exited firms can recycle back into the ecosystem by creating new spinout firms or taking jobs at existing scale-up firms. Entrepreneurs often start with unique insights about opportunities that their former employer did not pursue, giving them an early advantage for achieving product/market fit (Klepper 2007). Serial entrepreneurs who leave the firm they founded often generate useful entrepreneurial know-how and legitimacy, even if the firm ultimately failed (Zhang 2011). They can spread this knowledge both by creating new firms and by mentoring other entrepreneurs using their experiences. Spinout-based recycling allows for the Darwinian evolution of an ecosystem because the leaving founders can take what they feel are the most effective elements of the parent organization while leaving behind what they feel are needless or inferior elements (Klepper and Sleeper 2005).

The movement of workers between firms is also an important source of recycling within ecosystems. Employees bring with them insights and skills they developed at their previous employer as they move to new firms (Wu, Jin, and Hitt 2017). Working at innovative firms helps employees build their own technical and entrepreneurial skills, which they bring with them to their subsequent employers, making them more productive (Tambe and Hitt 2014; Braun et al. 2017). These actors bring with them technical and business insights, market knowledge, ties to customers and suppliers, and knowledge of organizational routines they acquired at their former employers (Feldman Ozcan and Reichstein 2019).

Recycling is triggered by particular events that affect firms and individuals. When a firm is acquired or goes public, its founders and early employees are able to ‘cash out’ and may choose to recycle into the ecosystem. For example, after a firm is acquired by an outside

company, its successful founders can return to the local entrepreneurial ecosystem as both serial entrepreneurs and as knowledgeable angel investors or mentors, helping to support further entrepreneurship within the ecosystem (DeTienne 2010). Their experience allows them to have unique insights into market dynamics that help them identify new entrepreneurial opportunities (Zahra 2008). Workers at that firm might use profits from stock options as seed capital for new ventures, or take what they have learned from the firm as they assume management or technical positions at other local firms.

But firm failure also triggers a release of resources back into the entrepreneurial ecosystem where they can be used by other local firms. The loss of a job decreases the opportunity cost of entrepreneurship (Frederiksen Wennberg and Balachandran 2016), allowing laid off workers to draw on the insights and ideas they had at their former job to identify new opportunities. These workers bring with them potentially valuable know-how and insights that can be used by others. Similarly the founders of these failed firms can learn from their experience, increasing their chances of succeeding in subsequent ventures.

These different ways of recycling are affected by a region's social and economic institutions. Some institutional configurations make a place 'sticky', keeping resources locally and making them available to local entrepreneurs in the ecosystem. For example, the ability of entrepreneurs and workers from failed ventures to recycle back into the ecosystem depends on the presence of a local culture that is tolerant of failure and setbacks. As Bahrami and Evans (1995, 81) argue: "the process of 'flexible recycling' is enhanced in the absence of the typical stigma associated with organisational failure." Other cultural structures may make it difficult for anyone associated with a firm failure to recycle back into the ecosystem. This may lead to brain drain where skilled workers leave the region for better economic or social prospects.

On the other hand, certain economic and institutional configurations may make recycling more common, such as regional economies dominated by secure civil service or health-related jobs; in such places workers who are laid off cannot easily relocate because of their partners' careers and instead they must seek other local jobs or create their new ventures in order to stay in the region (Harrison Cooper and Mason 2004). Similarly, high levels of amenities and deep social ties to a place will encourage founders and workers to stay after a successful exit. Recycling is therefore a contextual phenomenon that depends on place-specific institutions and cultures.

## *2.2 The role of anchor firms in entrepreneurial ecosystems*

Large firms are often important players in building a supportive ecosystem for innovative new ventures (Brown and Mason 2017; Spigel 2017). The headquarters of large multinational corporations, research universities, public research labs and hospitals have long been viewed as anchors for regional development (Agrawal and Cockburn 2003). Their relative size gives them outsized importance within regional economies, often through their influence on localized production networks and informal institutional norms that often provide the foundation for entrepreneurial ecosystems (Colombelli Paolucci and Ughetto 2017). As such, they are critical



players in how entrepreneurial ecosystems develop and ultimately help high-growth entrepreneurs. While both public and private sector organizations can act as anchors, we focus our discussion here on large corporate firms and their role as anchors in the entrepreneurial ecosystem.

Table 1 presents a framework for understanding the contributions of anchor firms to entrepreneurial ecosystems. First, anchor firms assist in the development of *talent*. Employment opportunities at anchor firms attract highly skilled workers to the region, some of whom may become future entrepreneurs (Wolfe and Gertler 2004). This ‘magnet’ function is often critical to the creation of a strong ecosystem. In addition to attracting global talent, anchors play a leading role in skills upgrading and training in the local labour market, through the provision of in-house training and on-the-job experience or through partnerships with local universities (Croce et al. 2016).

Second, anchor firms have wider *entrepreneurial effects*. New ventures can spin out of anchors, from either strategic corporate entrepreneurship activities or new ventures created by former employees without the permission of the parent firm (Klepper 2007). In either cases, these spinouts inherit technical and market knowledge, as well as organizational routines from the parent, providing them with an early source of competitive advantage. Founders of spinoffs often have superior knowledge of the marketplace, allowing them to more easily identify market opportunities and gain market legitimacy necessary to make early sales. Furthermore, the literature suggests that anchor firms can be a source of knowledge spillovers to nearby firms, through direct partnerships, observation or worker mobility (Lucas, Sands, and Wolfe 2009). Under the right conditions, local firms can integrate knowledge related to technical innovations and innovative practices into their own products, services and organizational routines (Gertler 2010). Informal knowledge flows through social and professional connections, frequently made when an employee works at an anchor firm before leaving to work at a nearby firm, are a crucial conduit for these knowledge spillovers (Whittington, Owen-Smith, and Powell 2009).

Third, anchor firms contribute to the creation of *formal institutional capacity* that supports the ecosystem. This capacity can be developed in several ways. For instance, the rapid growth and scaling up of a local venture creates a new pool of skilled angel investors who can support new rounds of high-growth entrepreneurship. Large firms will engage politically with local policymakers to create a more business-friendly environment. Anchors, particularly those founded by local entrepreneurs, have political power that can be used to lobby for the creation of new local programs or policies that strengthen the local economy. This might include investments in university programs, training programs, new infrastructure, and quality of life improvements such as parks and schools to attract and retain skilled workers to the region (Katz and Nowak 2018). However, this is not an automatic or deterministic process: ecosystem actors must take purposeful steps to help build a stronger entrepreneurial community. This is often achieved through civic engagement by leading members of the business and entrepreneurial community, who contribute their own time, energy, and civic capital to cultivate strong entrepreneurial communities (Feldman and Zoller 2012). Such ‘dealmakers’ or ‘ecosystem

coordinators' can help develop formal institutions, such as policies that fund and train local entrepreneurs or accelerators that help incubate them, as well as informal institutions such as supportive cultures, that help encourage and assist high-growth entrepreneurs.

Finally, anchor firms play a role in *building informal institutions*, specifically related to developing an entrepreneurial culture and acting as role models for potential entrepreneurs. The growth of a locally founded firm into a globally competitive anchor firm helps create a local cultural confidence in entrepreneurship, which can encourage other entrepreneurs to make their own similar journeys. The founders of such firms become local role models, directly and informally aiding other entrepreneurs in the community (Spigel 2013). They might inspire others to become entrepreneurs, angel investors or mentors. In this way a few dedicated entrepreneurs can help create a broader community that sustains an entrepreneurial culture and coordinates the flow of key resources throughout the ecosystem.

[Table 1 here]

These activities contribute to the health of the entrepreneurial ecosystem, improving its capacity to support high-growth firms. Anchors' size gives them the resources and legitimacy to take on major ecosystem roles, such as sponsoring new support programs or acceleration program. Their local supply chains create markets that entrepreneurs in the ecosystem can use to introduce new products and the alumni of anchors often become important local investors, mentors, or dealmakers.

But while one of the most important contributions anchor firms make to an entrepreneurial ecosystem is attracting highly skilled workers, we cannot assume that these workers will easily enter the ecosystem. Not all employees are willing to work in new ventures or scaling firms, which are often characterized by low levels of hierarchy, fuzzy job roles, and less job security than larger corporate or public employers (Stam 2013). Workers at start-ups tend to be younger, and more risk-oriented than their peers at larger employers and are often attracted by the prospect of having a more direct impact on a firm's development, as well as a 'cooler' firm culture (Ouimet and Zarutskie 2014).

Recycling from anchor firms is therefore not automatic; if workers leave an anchor employer they may prefer working for another large corporate employer in the region rather than a riskier new venture. The extent to which workers are willing to take on the risks of working at an entrepreneurial venture depends on context of their ecosystem. A supportive local culture helps employees develop the forms of entrepreneurial orientation and skills that ensures that they are willing to work at entrepreneurial firms (Roach and Sauermann 2015). This may include normalizing high job insecurity, frequent job changes, and accepting risky stock options in exchange for lower wages (Neff 2012). However, these cultural effects are not homogenous: even within very strong entrepreneurial ecosystems there are skilled workers who are more comfortable working at larger employers rather than smaller and riskier ones.

Thus, there is a tension in the potential effects of anchor firms on the surrounding entrepreneurial ecosystem. On one hand, anchors play a key role in attracting highly skilled workers to a region and increasing the entrepreneurial potential of the region through knowledge spillovers, institutional development, and local value chain creation. On the other hand, there is no reason to assume that the workers attracted to anchor firms have entrepreneurial mindsets or a desire to start or work at new ventures. Indeed, high wages at anchor firms increase the opportunity cost of spinout activities. An anchor firm whose organizational culture supports entrepreneurship is likely to attract workers with an entrepreneurial mindset, which in turn helps create and reproduce a region's entrepreneurial culture. Anchor firms that lack an entrepreneurial culture may not attract entrepreneurial workers and might actively prevent spinouts, hurting a region's entrepreneurial culture and ecosystem.

### *2.3 Anchor Firm Collapse, Recycling and the Evolution of Ecosystems*

Entrepreneurial ecosystems are inherently temporally dynamic, with their future development paths enabled and constrained by local economic and social histories (Spigel and Harrison, 2018). The success of both scale-ups and anchor firms attracts new entrepreneurial resources to the ecosystem such as skilled workers and investment capital, which can then recycle through the ecosystem, allowing newer rounds of entrepreneurs to benefit from them and over time pressing forward the ecosystem's evolution. This strengthens the ecosystem over time, allowing it to support new generations of startups and scale-ups and reproducing the support systems enabling growth.

The decline or loss of an anchor firm will therefore have a significant impact on an ecosystem. This may lead to the ecosystem and the broader regional economy declining as people and financial capital leave for more prosperous regions, which in turn will damage local institutions and support infrastructure for entrepreneurship. But the loss of an anchor firm might also catalyze ecosystem development, creating new opportunities and enriching the resource pool that entrepreneurs can draw on. The most obvious effect is the release of large numbers of skilled technical and managerial workers into the regional labour market. Some of these workers may become entrepreneurs themselves or go to work at local startups. In the most positive cases, newly unemployed workers may have severance packages that can serve as seed capital for new firms where they can pursue new entrepreneurial or technological opportunities their previous employer overlooked. However, these laid off workers might not recycle into the ecosystem, either because they took jobs at nearby large corporations or because they left the region for opportunities elsewhere. Finally, skilled workers laid off from an anchor firm might turn to necessity entrepreneurship and open small low-productivity consultancies with few growth prospects. The loss of an anchor firms may also mean the loss of a critical ecosystem actor, making it harder for support organizations to coordinate their activities. Finally, an anchor firm's decline might have a negative impact on a region's cultural confidence in entrepreneurship. These outcomes will contribute to an overall reduction of the ecosystem's capacity to support high-growth entrepreneurship.

In other words, there are two potential pathways that an ecosystem can follow after a shock, such as the decline or collapse of a regional anchor organization. As Figure 2 shows, the ability of an ecosystem to recover or even benefit from the loss of an anchor depends on the ability of resources released from the collapse of the anchor to recycle back into the ecosystem, either in the form of spinouts and entrepreneurship or the movement of highly skilled workers into local startups. At time  $t$  (Figure 2.a), the anchor firm attracts skilled workers and new resources such as financial capital, some of which recycles through the rest of the ecosystem, supporting new venture creation and growth. The anchor firm contributes to the development of new formal institutions such as industry associations or startup support groups, which in turn can provide additional support to the ecosystem. After a crisis, the resources built up in the anchor firm can either recycle into the ecosystem (Figure 2.b) or leave the region (Figure 2.c). In the former case, this creates a stronger ecosystem because new and growing ventures benefit from access to a high calibre workforce, as well as from the support they receive from the institutions and organizations seeded by the anchor firm. This in turn ensures that external resources, such as inbound investment, continue to flow into the regional economy. In the latter case, large-scale out-migration occurs as employees move elsewhere to find new career opportunities. This can contribute to a decline in the regional economy, with fewer resources available for new ventures and reducing the ability of local support organizations to contribute to the ecosystem.

[Figure 2 here]

How an ecosystem responds to a shock and more broadly how it develops over time depends on the extent to which entrepreneurial resources are recycled into the ecosystem after an exit. Recycling can be seen as a form of entrepreneurial resilience that enables regions to respond to a shock by recirculating important resources towards new aims rather than losing them completely. This can support the renewal of the regional economy along a different trajectory than it had when the anchor was still dominant (Martin 2011). Smaller, more dynamic startup firms may be able to weather a shock better than larger firms and the shock may even create more opportunities for them, which in turn allows them to absorb more resources coming out of other firms in the regional economy (Williams and Vorley 2014).

But while recycling has an intuitive logic and there are ample examples of spinouts from an anchor firm helping to establish strong ecosystems, there is only limited empirical evidence of whether or not recycling occurs within ecosystems, particularly after a shock, and how this process unfolds. There are substantial gaps in our knowledge about the dynamics of entrepreneurial ecosystems. This paper seeks to address these gaps in our knowledge by asking the following questions. Do workers at a failed anchor firm recycle back into their entrepreneurial ecosystem? And, do the processes of recycling change over time as the region and its institutions adapt to the loss of an anchor firm? Answering these questions provides greater insight into how recycling occurs in entrepreneurial ecosystems and the extent to which this recycling can help compensate for the loss of an anchor firm in a regional economy.

### **3. Methods**

#### *3.1 Case Study Context*

To address these issues we conducted an in-depth study of Waterloo, Canada to understand the dynamics of worker recycling within entrepreneurial ecosystems after the decline of a major anchor firm. Waterloo is a city-region of about 500,000 people about 100 kilometers west of Toronto. It is well known for its strengths in digital technology, wireless communications, and quantum computing (Vinodrai 2016). The region is ranked as one of the world's top entrepreneurial ecosystems (Startup Genome 2018) and is frequently held up in the literature as an example of a region characterized by technological innovation and entrepreneurship (Bramwell and Wolfe 2008). The city is characterized by a supportive entrepreneurial culture, which has generated high levels of trust and cooperation between entrepreneurs and community leaders. This culture is enhanced and reproduced by the presence of several highly effective local entrepreneurial support agencies, incubators, and accelerators. One agency in particular, Communitech, has taken the lead in coordinating the ecosystem by offering training, financing, programming and spaces for entrepreneurs to learn from each other.

Waterloo's ecosystem is based around two key anchors: the University of Waterloo (UW) and the smartphone company Blackberry (formerly Research in Motion or RIM). UW is well-known as an entrepreneurial university due to its permissive IP policy, which encourages research-based spinouts; its internal entrepreneurial culture, which attracts students and faculty interested in commercializing new technological advances; and a co-op educational program that sees students work directly for local and global firms as part of their degree. Blackberry was founded locally in 1984 as a pager manufacturer and went public in 1998 after pioneering the e-mail enabled cellphone (McQueen 2010). Though not a direct university spinout, it drew on the technical expertise of UW researchers and the skills of its co-op students and alumni as it grew to become a leader in the global cellphone market. However, Blackberry's fortunes shifted in 2008 as the company was unable to adapt to changes in the smartphone market, including the emergence of new competitors such as Apple's iPhone and Google's Android platform (McNish and Silcoff 2015).

As a result, the company's global workforce dropped from a high of over 17,500 in 2011 to fewer than 6,200 in 2015. This decline represented a profound shock to Waterloo's entrepreneurial ecosystem and the broader regional economy. While the company did not report employment by location or the number of jobs shed by region, newspaper reports suggest that at least 2,200 workers were laid off from the Waterloo headquarters alone. Local leaders expressed a fear of losing top talent from Blackberry to nearby Toronto as well as global technology clusters like Silicon Valley or Seattle. Losing this talent would weaken the region's economic strength and could ultimately lead to further losses as employers attracted to the region's strong technology labour pool followed the emigrating workers, potentially precipitating a broader downturn in the regional economy.

### *3.2 Data and Methodology*

Existing census data and other administrative data sources do not provide sufficient detail to examine the career trajectories of former Blackberry employees and their propensity to recycle into Waterloo's ecosystem. Indeed, the paucity of data on employee mobility and entrepreneurial endeavors is one of the chief challenges in studying entrepreneurial ecosystems. As Feldman and Lowe (2015, 1785) argue: "insufficient micro-level data has inhibited understanding of the underlying dynamic processes within regions that lead to and sustain, innovation and entrepreneurship." In response to these challenges, there has been a call for the use of alternative data sources that can capture new dynamics of entrepreneurial ecosystems and other phenomena (Strangler and Bell-Masterson 2015).

Data drawn from career-based social media platforms are increasingly popular way of studying large-scale trends in employment because they offer highly detailed data at the individual level. For example, Avnimelch and Feldman (2010) examine the role of anchor firms in creating new pools of entrepreneurs, Chen and Thompson (2015) look at skill balance and entrepreneurship, and Jiang Wang and Wang (2017) examine the career trajectories of credit analysts. Career-based social media platforms feature structured job histories uploaded by users along with other information such as their education, job location, job duties, and dates of employment. Users are incented to maintain up-to-date and accurate profiles because these platforms are used to find new jobs and connect with potential clients or partners..

We acquired employment data from one career-based social media platform on former Blackberry employees who listed their job functions as either engineering or information technology. By restricting job function, we were able to focus wholly on workers with technical skills, rather than managers or administrators. This provides clearer insight into the recycling of valuable technology workers in an ecosystem. While the data is highly structured (meaning fields such as job title and employer are delineated), user-entered fields such as job title, job duration, and location are very inconsistent. A manual cleaning process was necessary to resolve confusing or unclear entries. For example, Blackberry was referred to as Blackberry, RIM, Research in Motion, or by the name of a subsidiary. In some cases, users did not include complete data about their jobs, such as dates of employment or location.

Figure 3 illustrates the data selection and reduction process used to identify former Blackberry workers in Waterloo. In 2016, a total of 30,024 former Blackberry workers are listed on the platform, including 5,292 former Blackberry workers who classified themselves as either engineering and IT workers. While this does not likely capture the entire population of former Blackberry technology workers, we see no evidence of systematic bias in the dataset. We further narrowed our selection to the 1,082 individuals in engineering and IT roles who reported that at least one of their former jobs was located at Blackberry's headquarters in Waterloo. We then limited our analysis of recycling in Waterloo's entrepreneurial ecosystem to the 782 workers who left their jobs after Blackberry's decline began in 2008 to focus on the impact of anchor firm collapse on the local entrepreneurial ecosystem. While not exhaustive, we believe that this method captures a high proportion of the technical talent housed at Blackberry's headquarters

and believe that the utility of career-based social media platforms would be similar for all highly skilled tech workers regardless of whether they pursued employment or entrepreneurship related pathways.

[Figure 3 here]

For each individual we coded variables relating to their current and former employers and their personal characteristics. First, we coded the characteristics of their past five employers (including their current employer). These characteristics include: 1) firm size, classified as micro (1 to 5 employees), small (6 to 50 employees), medium (51 to 500 employees) and large (more than 500 employees) as recorded by their employer's public profile on the platform; 2) the firm's primary sector, classified as technology, finance / insurance, health / medical, or other based on an analysis of the firm's operations; and 3) whether or not the firm was a member of Waterloo's entrepreneurial ecosystem. Ecosystem membership was determined using three criteria: A) if the firm was founded in the Waterloo region; B) if the firm was less than ten years old; and C) if the firm had a profile on Crunchbase. Crunchbase is a user-maintained database of firms that are actively seeking venture financing or that have otherwise scaled significantly; it is a popular data source for researchers due to its scope and the relative quality of its data. More than 90 research papers have already drawn on Crunchbase because it is one of the largest publicly available data sources for early stage entrepreneurial ventures (Dalle et al., 2017). While not complete, its coverage of smaller firms makes it a superior source for this study than traditional business data sources such as Dunn and Bradstreet.

Second, individual characteristics were coded. These included: 1) job tenure at Blackberry; 2) whether or not an individual had received undergraduate or graduate degrees in Waterloo; 3) whether or not an individual was currently employed in a firm in Waterloo's entrepreneurial ecosystem; and 4) whether or not the individual had experience as an entrepreneur, defined as having listed a job title such as CEO, president, founder, co-founder, or owner. This allowed us to characterize individuals' post-Blackberry employment and entrepreneurial activities and examine how this related to their prior experience at Blackberry.

## **4. Recycling and Labour Market Transitions in Waterloo**

### *4.1 Descriptive Results*

While Blackberry's decline in the smartphone market began in 2008, Figure 4 shows that the exodus of technical workers from its Waterloo headquarters began in 2010 and reached its peak in 2014. The figure also shows the proportion working in the entrepreneurial ecosystem, a discussion we return to below. Table 2 summarizes some of the key characteristics of former Blackberry employees included in our analysis. The majority of those who left Blackberry from 2008 onwards were new to the company, 526 workers in the sample (67.3%) had less than five years of experience in the firm before leaving. Of these, 18.7% of the overall sample had less than a year of experience at the firm and had attended the University of Waterloo, suggesting

that they had been at the firm as part of a temporary co-op work placement. Less than a third of the sample (226 people) had been at Blackberry for more than five years before leaving. This suggests that Blackberry shed younger workers and attempted to retain their more experienced employees. Former Blackberry workers have largely remained in the technology sector. More than three-quarters of the sample (77.9%) were still employed by technology firms in 2016. Importantly, slightly more than half (56.1%) of these former Blackberry employees were still working a large firm (500+ employees). This suggests that many of Blackberry employees prefer to work at larger corporate firms, due to familiar management structures, the presumably higher wages, and/or the likelihood of improved job security often associated with larger organizations. This makes them less likely to recycle into the ecosystem. This confirms that recycling should not be viewed as an automatic process: even within entrepreneurial places, workers at larger firms are likely to try to find employment at other large firms.

[Table 2 and Figure 4 here]

#### *4.2 Worker mobility and entrepreneurship*

The majority of former Blackberry workers (54.6%) remained in the Waterloo region, with another 14.3% finding a job in nearby Toronto. Moreover, there was relatively limited migration to other North American technology centers like Silicon Valley (8.8% of the sample) or Seattle (1.3%). This suggests that, contrary to the expectations of local officials, there was not a substantial out-migration of talent due to Blackberry's decline. Table 3 breaks this down further looking at current location by amount of experience at Blackberry. It shows that the longer workers had been employed at Blackberry (and therefore, the longer their likely tenure in Waterloo), the more likely they were to stay in the region even if their skills and experience may have allowed them to move elsewhere for employment. Despite their more developed skills, these more experienced workers were less footloose than their newer colleagues.

[Table 3 Here]

Former Blackberry workers exhibited minimal entrepreneurial activity. This is not unexpected given that many went to work for large firms after leaving Blackberry. Only 6.8% (53) of the sample had job titles that indicated that they were founders. Moreover, only 12 of these new ventures (22.6% of all new ventures formed, or 1.5% of the total sample) could be described as high growth firms in Waterloo's entrepreneurial ecosystem. The majority of new ventures in the sample are best characterized as small technology consultancies, service firms or retail shops with few growth prospects. This contradicts early predictions by local policymakers that the decline of Blackberry would be a boon to high-growth entrepreneurship, but instead reflects the reality that Blackberry's organizational culture discouraged entrepreneurship amongst its employees, and the anchor did not attract many technology workers with entrepreneurial ambitions.



Notably, the majority of former Blackberry workers who became entrepreneurs left early in the firm's decline, with 20 (37%) of the total entrepreneurs leaving the firm in 2011 (Figure 5). As shown in Figure 5, the number of entrepreneurial ventures formed by ex-Blackberry employees declined year-on-year after 2011. And, the majority of new ventures (36 or 67.9%) were located in Waterloo (25) or the neighboring Toronto region (11), confirming earlier work that suggests that entrepreneurs prefer to start their ventures in the regions where they already live (Stam, 2007).

[Figure 5 here]

#### *4.3 Recycling into the entrepreneurial ecosystem*

Spinoffs were not the only way in which recycling from a declining anchor firm can influence the entrepreneurial ecosystem. The movement of skilled workers from an anchor firm to start-ups and scale-ups is also an important outcome. As shown earlier in Figure 4, there was a growing number of former Blackberry workers who entered Waterloo's wider entrepreneurial ecosystem after 2008. Overall, almost a quarter of the sample (192 of 782) worked in the entrepreneurial ecosystem, meaning they took at a job at a high-growth firm based in Waterloo. Of the 517 workers leaving between 2008 and 2013, 17.8% worked in the entrepreneurial ecosystem. By contrast, amongst the 265 workers departing in subsequent years, 37.7% worked in the entrepreneurial ecosystem. Overall, this demonstrates a robust level of recycling, with substantial levels of technical talent from Blackberry in local high-growth ventures. Moreover, the growing proportion of workers entering the ecosystem over time suggests that the capacity of the ecosystem to absorb these workers and the willingness by former Blackberry workers to work at startups in the ecosystem grew over this period. This shows that recycling is not static, but changes over time as the nature of local employment opportunities and the social value of working in the ecosystem shift.

Table 4 breaks down participation in Waterloo's entrepreneurial ecosystem based on years of experience at Blackberry. Interestingly, workers with more experience at Blackberry (5 to 10 years or more than 10 years) were the most likely to recycle into the local ecosystem as opposed to younger workers with less work experience. This suggests that new ventures in the ecosystem seek top technical talent with substantial experience in mobile technology rather than less experienced and less expensive junior developers.

[Table 4 here]

Several interlinked trends are responsible for the increased capacity of the ecosystem. First, since 2008, there has been an increase in the flow of venture capital into the Waterloo ecosystem. Figure 6 shows that venture capital investments reached a peak of \$368 million (USD) in 2016, including a \$168 million investment in Thalmic Labs (now North), a wearable technology company that took on at least seven former Blackberry technology workers (CVCA

2016). Other high-growth firms in Waterloo received substantial venture capital investment. The steady increase in venture capital flows allowed local firms to expand coincident with when increasing number of former Blackberry workers were available.

[Figure 6 here]

Second, entrepreneurial organizations throughout the region increased their efforts to link former Blackberry workers with local firms. Organizations such as Communitech, established in 1997 by the former founders of Blackberry along with other local business leaders, developed a series of programs linking start-ups looking for skilled technical workers with former Blackberry technical employees. Many of these programs included other partners, including the provincial government and the Canadian Digital Media Network. A 2013 news article appropriately titled ‘RIM Refugees,’ details initiatives such as workshops, job boards, and employment fairs designed to encourage entrepreneurship amongst laid off Blackberry workers, connect them with the local ecosystem, and encourage local firms to expand their operations in order to take advantage of available talent (Sher, 2013).

Finally, Communitech, the region’s main ecosystem support organization, invested heavily in expanding the spaces and programming that supported the creation of a new generation of tech-based start-ups firms and convince tech companies in places like Silicon Valley to open offices in Waterloo to take advantage of local talent. These new firms offered a new source of demand for skilled workers, especially seasoned workers who could provide a depth of experience and knowledge to these fledgling firms. For example, it opened the Communitech Hub (Vinodrai 2016) to house the start-up programs run by the local universities; Communitech also developed programming to assist start-ups and link large corporate clients with the local startup ecosystem.

## **5. Discussion**

Blackberry’s decline was the result of a new disruptive technology — the iPhone — and the failure of its management to recognize shifts in the smartphone market. The job losses that occurred from 2008 onwards represented a profound economic and cultural shock to the Waterloo region. As the company’s decline intensified, there were concerns that this would damage the ‘Waterloo miracle’ that allowed a highly innovative technology economy to thrive in a relatively small region. However, this economy has grown as Blackberry declined, driven largely through the development of an increasingly dynamic entrepreneurial ecosystem. Part of this growth is due to the recycling of workers from Blackberry into the local ecosystem instead of them leaving the region to take up jobs elsewhere. This mitigated the effects of Blackberry’s decline and helped avoid a shock that could have ruptured the regional economy. Waterloo’s experience resembles the ‘anchor decline and recycling’ case in Figure 2b above. The institutional structure of the ecosystem enabled recycling of skilled workers to local high-growth firms rather than them leaving the ecosystem by either migrating out of the region or turning to lower-growth firms in the region.

Our data reveal substantial levels of recycling into Waterloo's entrepreneurial ecosystem. Approximately one-quarter of technology workers who left the firm are now working in high-growth startups in the ecosystem as opposed to migrating to other regions or working for lower-growth firms in the region. However, the nature of recycling differs from the implicit assumptions made in the literature about how recycling works. We found very low levels of *direct* entrepreneurial activity by the skilled technologists and engineers who left BlackBerry. Only 1.5% of those who left BlackBerry during the study period went on to found high-growth technology ventures in Waterloo. This counters the expectation that large technology firms should seed numerous spinouts. While some large global technology firms such as Google or Hewlett-Packard have historically encouraged spinouts, other large anchors develop corporate cultures that discourage spinouts both through the direct threat of lawsuits but also by attracting less entrepreneurial employees. Thus, the loss of a large anchor firm will not necessarily lead to dynamic start-up activity by former workers, even in very strong entrepreneurial ecosystems. The entrepreneurial efforts of BlackBerry's former employees were primarily related to lifestyle entrepreneurship: laid off workers replacing their lost wages with low-growth firms of limited potential.

However, our data show that most recycling occurred through the movement of workers away from declining firms and into innovative start-up and scale-up firms in the local ecosystem. Employment in entrepreneurial firms, rather than entrepreneurship itself, was the most important form of recycling associated with BlackBerry's decline. The skilled workers from BlackBerry did not create their own companies but many appeared willing to work at high-growth new ventures. This trend increased over time, with the proportion of workers who left BlackBerry to enter Waterloo's ecosystem increasing in the later years of the study. As argued above, this suggests that region's capacity to absorb these workers into the entrepreneurial ecosystem increased over time, driven by formal and informal institutional forces and increased venture capital investments. The flow of workers from BlackBerry to firms in the local entrepreneurial ecosystem was – in part – made possible by both the increasing number of new ventures and the increasing venture capital investment into Waterloo-based startups. Firms in Waterloo's ecosystem hired the most experienced BlackBerry workers, suggesting they had the resources required to pay the higher salaries these workers could demand. Without significant venture investment into Waterloo's ecosystem, these employment opportunities would either not exist or not be remunerative enough to keep them in the region.

Waterloo's institutional structure helped coordinate connections between new firms who needed skilled labour and the skilled workers leaving BlackBerry. Organizations like Communitech worked to build the region's global presence to attract new investment, while at the same time working to create stronger local networks within the business and technology community. As BlackBerry's decline worsened, Communitech and other local organizations created both entrepreneurship training programs for former BlackBerry employees (which did not appear to be effective) as well as networking events and other programs to connect these workers with start-ups and scale-ups who needed top technical talent.

Communitech's capacity to mediate this crisis was not an accident. The organization received substantial support from Blackberry throughout its history. This allowed Communitech to build a reputation as an intermediary between the entrepreneurial community, major anchor firms like Blackberry, and local and provincial governments. Communitech's local reputation as an organization responsive to the needs of entrepreneurs allowed it to achieve the necessary buy-in to address the crisis. The organization's ability to help facilitate recycling from the declining Blackberry to the more dynamic local entrepreneurial ecosystem was ironically made possible by Blackberry's engagement with the organization over the previous decades, which helped Communitech establish itself as a key player within the ecosystem.

Overall, these results suggest that entrepreneurial recycling is not a 'natural' part of ecosystems. Rather, it is temporally dynamic, evolutionary process linked to a place's pre-existing institutional, economic, and cultural structures. As the economic and social institutions of a place change, so does the quantity of people recycling into the ecosystem. The ability of workers from declining anchor firms to recycle back into the ecosystem depends on a region's culture (if it is accepting or intolerant of people associated with a failure and if the culture promotes entrepreneurialism), its formal institutions or organizations (who can link employees with new ventures who need highly skilled workers) and economic systems (if the new firms have the financial resources to afford the wages of those leaving anchor firms). Recycling from Blackberry was not inevitable: it depended on the existence of local organizations such as Communitech to create pathways to channel highly skilled technical workers between the anchor and the ecosystem. In this case, Waterloo's ecosystem was 'sticky', creating pathways not only to retain workers in the region but to move them into the start-up and scale-up firms that needed their expertise.

## **6. Conclusion**

Entrepreneurial ecosystems are not static collections of actors and factors: they are dynamic social and economic systems that provide the resources required for innovative new ventures to form and grow. Skilled workers are one of the most important resources for entrepreneurial growth. The ability of regions to attract or produce these workers and ensure that entrepreneurial ventures are able to benefit from this talent pool is a crucial component of successful entrepreneurial ecosystems. Anchor firms are key players in building this talent pool — they attract skilled workers globally through their global recruitment activities and work to build it up locally through partnerships with local universities and colleges. However, there is almost no empirical evidence of the recycling of talent from anchor firms to the surrounding local or regional ecosystem. This is a major research gap in the literature, especially since this is identified as a significant process through which ecosystems reproduce and change over time.

By examining the labour mobility of anchor firm employees after a shock, this paper provides new empirical evidence for how entrepreneurial recycling works within the dynamics of entrepreneurial ecosystems. Employing a novel methodology to gather data on the career paths of former Blackberry workers, the paper finds surprisingly little evidence of entrepreneurial

activity being undertaken by these highly skilled workers. Only a small proportion of technical workers who left Blackberry after its decline started new ventures and even fewer of these were high-growth firms. Rather, former anchor firm employees were more likely to find employment in the local ecosystem and the likelihood of this pattern increased over time. Notably, those who had worked at Blackberry the longest were the most likely to recycle into the ecosystem, which reflects both their embeddedness in the region, as well as the importance placed on technical experience by fast-growing firms.

Because of the active recycling into the ecosystem through labour mobility, Waterloo's ecosystem avoided an economic trajectory characterized by resource loss, outmigration, and reduced entrepreneurial ambitions. Unlike other regions that have lost an anchor firm, such as Nortel (Ottawa) in the early 2000s, the decline of Blackberry did not dampen activity in the local entrepreneurial ecosystem. Instead, local organizations like Communitech were central in creating formal and informal institutions that connected departing Blackberry employees with local scale-up firms. This encouraged recycling, as evidenced by the increased flow of workers from Blackberry to the ecosystem as the anchor's decline worsened and the capacity of local entrepreneurial ventures to absorb these workers increased. Ironically, Blackberry itself had a hand in forming these institutional structures, demonstrating the importance of evolutionary conditions in the recycling process.

Overall, this paper makes three contributions to the entrepreneurial ecosystems and regional economies literature. First, it exploits new data sources and methods to track employee mobility within and between entrepreneurial ecosystems. These data provide new perspectives on labour market transitions and the role of human capital in entrepreneurial growth. Second, this paper provides some of the first empirical evidence for entrepreneurial recycling. The findings suggest that the largest impact of shocks to local anchors is the movement of skilled workers to high-growth entrepreneurial ventures, rather than spurring new waves of entrepreneurship. Third, it demonstrates the evolutionary and dynamic nature of ecosystems and the key role of local institutional structures in addressing sudden shocks to the local economy.

However, we must be aware of the limitations posed by working with alternative datasets like the one used here. The present study only looked at technical workers. It may be that managerial workers, for instance those in operations, marketing, or sales, are more likely to either leave the region or take up jobs in other large firms. While technology firms obviously prize technology skills, the business skills these managerial workers bring are important to firm growth. Similarly, we cannot show that firms that hired these recycling workers performed better than their peers that didn't or otherwise assign causality between taking advantage of the recycled skills and improved firm outcomes. We must therefore be cautious in generalizing these findings. Secondly, career-based social media platforms present significant issues with missing data, particularly around the location of employers and the timing and duration of their work there. This limits our ability to construct detailed career histories to follow workers from job to job and link these with individual characteristics such as work experience, age, or gender. Finally, we look at only one ecosystem in this study. Further research is necessary to determine if

Waterloo's experience is typical for an entrepreneurial ecosystem following the loss of a major anchor or if its institutional structure has helped insulate the economy from a more serious decline.

## Works cited

- Agrawal, Ajay, and Iain Cockburn. 2003. "The Anchor Tenant Hypothesis: Exploring the Role of Large, Local, R&D-Intensive Firms in Regional Innovation Systems." *International Journal of Industrial Organization* 21: 1227–1253.
- Alvedalen, Janna, and Ron Boschma. 2017. "A Critical Review of Entrepreneurial Ecosystems Research: Towards a Future Research Agenda." *European Planning Studies* 25 (6): 887–903.
- Auerswald, Philip E, and Lokesh Dani. 2017. "The Adaptive Life Cycle of Entrepreneurial Ecosystems: the Biotechnology Cluster." *Small Business Economics* 49 (1): 97–117.
- Autio, Erkko, Satish Nambisan, Llewellyn D W Thomas, and Mike Wright. 2017. "Digital Affordances, Spatial Affordances, and the Genesis of Entrepreneurial Ecosystems." *Strategic Entrepreneurship Journal*, September.
- Avnimelech, Gil, and Maryann Feldman. 2010. "Regional Corporate Spawning and the Role of Homegrown Companies." *Review of Policy Research* 27 (4): 475–489.
- Bahrami, Homa, and Stuart Evans. 1995. "Flexible Re-Cycling and High-Technology Entrepreneurship." *California Management Review* 37 (1): 62–89.
- Bramwell, Allison, and David A Wolfe. 2008. "Universities and Regional Economic Development: the Entrepreneurial University of Waterloo." *Research Policy* 37: 1175–1187.
- Brown, Ross, and Colin Mason. 2017. "Looking Inside the Spiky Bits: a Critical Review and Conceptualisation of Entrepreneurial Ecosystems." *Small Business Economics* 49 (1): 11–30.
- Brown, Ross, Colin Mason, and Suzanne Mawson. 2014. *Increasing "the Vital 6 Percent": Designing Effective Public Policy to Support High Growth Firms*.
- Brown, Ross, Suzanne Mawson, and Colin Mason. 2017. "Myth-Busting and Entrepreneurship Policy: the Case of High Growth Firms." *Entrepreneurship & Regional Development* 45 (1): 1–30.
- Casper, Steven. 2007. "How Do Technological Clusters Emerge and Become Sustainable? Social Network Formation and Inter-Firm Mobility Within the San Diego Biotechnology Cluster." *Research Policy* 36: 438–455.
- Chen, Li-Wei, and Peter Thompson. 2015. "Skill Balance and Entrepreneurship Evidence From Online Career Histories." *Entrepreneurship Theory and Practice* 40 (2): 289–305.
- Colombelli, A., Paolucci, E., & Ughetto, E. (2017). Hierarchical and relational governance and the life cycle of entrepreneurial ecosystems. *Small Business Economics*, 49(1), 1–17.
- Croce, Giuseppe, Edoardo di Porto, Emanuela Ghignoni, and Andrea Ricci. 2016. "Agglomeration and Workplace Training: Knowledge Spillovers Versus Poaching." *Regional Studies* 51 (11): 1635–1651. doi:10.1080/00343404.2016.1230270.
- Dahl, Michael S, and Olav Sorenson. 2012. "Home Sweet Home: Entrepreneurs' Location Choices and the Performance of Their Ventures." *Management Science* 58: 1059–1071.
- Dalle, J.-M., Besten, den, M., & Menon, C. (2017). Using Crunchbase for economic and managerial research. OECD Science, Technology and Industry Working Papers. OECD: Paris.
- DeTienne, Dawn R. 2010. "Entrepreneurial Exit as a Critical Component of the Entrepreneurial Process: Theoretical Development." *Journal of Business Venturing* 25 (2): 203–215.
- Dubini, Paola. 1989. "The Influence of Motivations and Environment on Business Start-Ups: Some Hints for Public Policies." *Journal of Business Venturing* 4 (1): 11–26.

- Eckardt, Rory, Bruce C Skaggs, and David P Lepak. 2018. "An Examination of the Firm-Level Performance Impact of Cluster Hiring in Knowledge-Intensive Firms." *Academy of Management Journal* 61 (3): 919–944. doi:10.5465/amj.2016.0601.
- Feld, Brad. 2012. *Startup Communities: Building an Entrepreneurial Ecosystem in Your City*. Hoboken, NJ: Wiley.
- Feldman, Maryann, and Nichola Lowe. 2015. "Triangulating Regional Economies: Realizing the Promise of Digital Data." *Research Policy*.
- Feldman, Maryann, and Ted D Zoller. 2012. "Dealmakers in Place: Social Capital Connections in Regional Entrepreneurial Economies." *Regional Studies* 46 (1): 23–37.
- Feldman, M. P., Ozcan, S., & Reichstein, T. (2019). Falling Not Far from the Tree: Entrepreneurs and Organizational Heritage. *Organization Science*, 30(2), 337–360.
- Frederiksen, L., Wennberg, K., & Balachandran, C. (2016). Mobility and Entrepreneurship: Evaluating the Scope of Knowledge-Based Theories of Entrepreneurship. *Entrepreneurship Theory and Practice*, 40(2), 359–380.
- Fritsch, M., & Storey, D. J. (2014). Entrepreneurship in a Regional Context: Historical Roots, Recent Developments and Future Challenges. *Regional Studies*, 48(6), 939–954.
- Gertler, Meric S. 2010. "Rules of the Game: the Place of Institutions in Regional Economic Change" 44: 1–15.
- Gjerløv-Juel, P., & Guenther, C. (2018). Early employment expansion and long-run survival examining employee turnover as a context factor. *Journal of Business Venturing*, 1–0.
- Harrison, Richard T, Sarah Y Cooper, and Colin M Mason. 2004. "Entrepreneurial Activity and Dynamics of Technology-Based Cluster Development: the Case of Ottawa." *Urban Studies* 41: 1045–1070.
- Hayter, Christopher S. 2016. "A Trajectory of Early-Stage Spinoff Success: the Role of Knowledge Intermediaries Within an Entrepreneurial University Ecosystem." *Small Business Economics* 47 (3): 633–656.
- Isenberg, Daniel J. 2010. "The Big Idea: How to Start an Entrepreneurial Revolution." *Harvard Business Review* 88: 40–50.
- Jiang, John Xuefeng, Isabel Yanyan Wang, and K Philip Wang. 2017. "Revolving Rating Analysts and Ratings of MBS and ABS: Evidence From LinkedIn." *Management Science*, January.
- Katz, Bruce, and Jeremy Nowak. 2018. *The New Localism : How Cities Can Thrive in the Age of Populism*. Washington D.C.: Brookings Institution Press.
- Kerr, William R. 2018. *The Gift of Global Talent: How Migration Shapes Business, Economy & Society*. Stanford: Stanford Business Books.
- Klepper, Steven. 2007. "Disagreements, Spinoffs, and the Evolution of Detroit as the Capital of the U.S. Automobile Industry." *Management Science* 53 (4): 616–631. doi:10.1287/mnsc.1060.0683.
- Klepper, S., & Sleeper, S. (2005). Entry by Spinoffs. *Management Science*, 51(8), 1291–1306.
- Lucas, Mathew, Anita Sands, and David A Wolfe. 2009. "Regional Clusters in a Global Industry: ICT Clusters in Canada." *European Planning Studies* 17 (2): 189–209.
- Lowe, N. J., & Feldman, M. P. (2017). Institutional life within an entrepreneurial region. *Geography Compass*, 11(3), e12306–10.
- Mack, Elizabeth, and Heike Mayer. 2016. "The Evolutionary Dynamics of Entrepreneurial Ecosystems." *Urban Studies* 53 (10): 2118–2133.



- Malecki, Edward J. 2018. "Entrepreneurship and Entrepreneurial Ecosystems." *Geography Compass*, 2018-01-08, e12359. doi:10.1111/gec3.12359.
- Martin, R. (2011). Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography*, 12(1), 1–32.
- Martin, Ron, and Peter Sunley. 2015. "On the Notion of Regional Economic Resilience: Conceptualization and Explanation" 15 (1): 1–42.
- Mason, Colin M, and Richard T Harrison. 2006. "After the Exit: Acquisitions, Entrepreneurial Recycling and Regional Economic Development." *Regional Studies* 40 (1): 55–73.
- Mason, Colin M, and Ross Brown. 2014. *Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship*. The Hague.
- McNish, Jacquie, and Sean Silcoff. 2015. *Losing the Signal: the Untold Story Behind the Extraordinary Rise and Spectacular Fall of Blackberry*. First edition. New York: Flatiron Books.
- McQueen, Rod. 2010. *Blackberry: the Inside Story of Research in Motion*. Toronto, Ont: Key Porter Books.
- Motoyama, Yasuyuki, and Karren Knowlton. 2016. "From Resource Munificence to Ecosystem Integration: the Case of Government Sponsorship in St. Louis." *Entrepreneurship & Regional Development* 28 (5-6): 448–470.
- Neff, Gina. 2012. *Venture Labor: Work and the Burden of Risk in Innovative Industries*. Cambridge, MA: MIT Press.
- Nicotra, M., Romano, M., Del Giudice, M., & Schillaci, C. E. (2017). "The causal relation between entrepreneurial ecosystem and productive entrepreneurship: a measurement framework". *The Journal of Technology Transfer*, 29(1): 19–34.
- Nylund, Petra A, and Boyd Cohen. 2017. "Collision Density: Driving Growth in Urban Entrepreneurial Ecosystems." *International Entrepreneurship and Management Journal* 13 (3): 757–776. doi:10.1007/s11365-016-0424-5.
- Ouimet, Paige, and Rebecca Zarutskie. 2014. "Who Works for Startups? the Relation Between Firm Age, Employee Age, and Growth." *Journal of Financial Economics* 112 (3): 386–407.
- Roach, Michael, and Henry Sauermann. 2015. "Founder or Joiner? the Role of Preferences and Context in Shaping Different Entrepreneurial Interests." *Management Science* 61 (9): 2160–2184.
- Roundy, Philip T. 2016. "Start-Up Community Narratives: the Discursive Construction of Entrepreneurial Ecosystems." *The Journal of Entrepreneurship* 25 (2): 232–248.
- Sauermann, H. (2017). Fire in the belly? Employee motives and innovative performance in start-ups versus established firms. *Strategic Entrepreneurship Journal*, 12(4), 423–454.
- Spigel, Ben. 2013. "Bourdieuian Approaches to the Geography of Entrepreneurial Cultures." *Entrepreneurship & Regional Development* 25: 804–818.
- Spigel, Ben. 2017. "The Relational Organization of Entrepreneurial Ecosystems." *Entrepreneurship Theory and Practice* 41 (1): 49–72.
- Spigel, Ben, and Richard T Harrison. 2018. "Towards a Process Theory of Entrepreneurial Ecosystems." *Strategic Entrepreneurship Journal* 12 (1): 151–168.
- Stam, Erik. 2015. "Entrepreneurial Ecosystems and Regional Policy: a Sympathetic Critique." *European Planning Studies* 23 (9): 1759–1769.
- Stam, Erik. 2013. "Knowledge and Entrepreneurial Employees: a Country-Level Analysis." *Small Business Economics* 41 (4): 887–898. doi:10.1007/s11187-013-9511-y.

- Stam, Erik, and Ben Spigel. 2018. "Entrepreneurial Ecosystems." In *The SAGE Handbook of Small Business and Entrepreneurship*, edited by Robert Blackburn, Dirk de Clercq, and Harna Heinonen. London: SAGE Publications Ltd.
- Startup Genome. 2018. *Global Startup Ecosystem Report 2018: Succeeding in the New Era of Technology*. San Francisco.
- Strangler, David, and Jordan Bell-Masterson. 2015. *Measuring an Entrepreneurial Ecosystem*. Kansas City.
- Tambe, Prasanna, and Lorin M Hitt. 2014. "Job Hopping, Information Technology Spillovers, and Productivity Growth." *Management Science* 60 (2): 338–355. doi:10.1287/mnsc.2013.1764.
- Thompson, Tracy, Jill Purdy, and Marc J Ventresca. 2017. "How Entrepreneurial Ecosystems Take Form: Evidence From Social Impact Initiatives in Seattle." *Strategic Entrepreneurship Journal*, 2017-11-24. doi:10.1002/sej.1285.
- Toft-Kehler, R., Wennberg, K., & Kim, P. H. (2014). Practice makes perfect: Entrepreneurial-experience curves and venture performance. *Journal of Business Venturing*, 29(4), 453–470.
- Van de Ven, Andrew. 1993. "The Development of an Infrastructure for Entrepreneurship." *Journal of Business Venturing* 8: 211–230.
- Vinodrai, T. 2006. Reproducing Toronto's design ecology: Career paths, intermediaries, and local labor markets. *Economic Geography* 82(3): 237-263.
- Vinodrai, T. 2016. A city of two tales: Innovation, talent attraction and governance in Canada's Technology Triangle. In *Growing Urban Economies: Innovation, Creativity, and Governance in 21st Century Canadian City-Regions*, ed. D.A. Wolfe and M.S. Gertler. Toronto: University of Toronto Press.
- Wapshott, R., & Mallett, O. (2016). *Managing Human Resources in Small and Medium-Sized Enterprises*. New York: Routledge.
- Whittington, K B, Jason Owen-Smith, and Walter Powell. 2009. "Networks, Propinquity, and Innovation in Knowledge-Intensive Industries." *Administrative Science Quarterly* 54 (1): 90–122. doi:10.2189/asqu.2009.54.1.90.
- Williams, N., & Vorley, T. (2015). The impact of institutional change on entrepreneurship in a crisis-hit economy: the case of Greece. *Entrepreneurship & Regional Development*, 27(1-2), 28–49. <http://doi.org/10.1080/08985626.2014.995723>
- Wolfe, David A, and Meric S Gertler. 2004. "Clusters From the Inside and Out: Local Dynamics and Global Linkages." *Urban Studies* 41: 1071–1093.
- World Economic Forum. 2013. *Entrepreneurial Ecosystems Around the Globe and Company Growth Dynamics*.
- Wu, Lynn, Fujie Jin, and Lorin M Hitt. 2017. "Are All Spillovers Created Equal? a Network Perspective on Information Technology Labor Movements." *Management Science*, July, mnsc.2017.2778.
- Ylinenpää, H. (2009). Entrepreneurship and Innovation Systems: Towards a Development of the ERIS/IRIS Concept. *European Planning Studies*, 17(8), 1153–1170.
- Zahra, Shaker A. 2008. "The Virtuous Cycle of Discovery and Creation of Entrepreneurial Opportunities." *Strategic Entrepreneurship Journal* 2 (3): 243–257.
- Zhang, Junfu. 2011. "The Advantage of Experienced Start-Up Founders in Venture Capital Acquisition: Evidence From Serial Entrepreneurs." *Small Business Economics* 36 (2): 187–208. doi:10.1007/s11187-009-9216-4.

Table 1: The contributions of anchor firms to entrepreneurial ecosystems

Talent	Global talent attraction	Highly skilled global workers attracted to region to work at anchor firm
	Local labour upskilled	Anchor firm increases skills of local workers through either in-house training or supporting programs at local universities
Entrepreneurial effects	Spinoff creation	Workers at anchor firms form their own new ventures that take advantage of their unique skillset
	Worker mobility & knowledge spillovers	Workers attracted to anchor firm leave to work at local firms, bringing with them unique technological and market insights
Formal institutional capacity	Business leadership	Founders and senior managers of local anchor firms help build regional industry associations and formal organizations to support entrepreneurship and innovation
	Dealmaking	Founders and senior managers help build local networks and connect entrepreneurs with supporters
	Corporate venture capital & angel investing	Anchor firms and their founders provide early stage equity investment in new ventures
Informal institution building	Entrepreneurial culture	Anchor firm leaders normalize risk taking and entrepreneurial behaviours
	Role models	Anchor firm leaders provide inspiration to potential entrepreneurs

*Source: Authors' conceptualization based on the literature*

Table 2 Key characteristics of former Blackberry employees

<b>Key characteristics</b>	<b>Count (%)</b>
<i>Years of experience at Blackberry</i>	
Co-op term	146 (18.7)
New to firm (< 2 years)	253 (32.4)
Some firm experience (2 to 5 years)	127 (16.2)
Established in firm (5 to 10 years)	171 (21.9)
Embedded in firm (> 10 years)	55 (7.3)
Unknown / not specified	30 (3.8)
<i>Sector of current employer</i>	
Financial services	42 (5.4)
Healthcare / medical services	18 (2.3)
Technology	609 (77.9)
Other	87 (11.1)
Unknown / not specified	26 (3.3)
<i>Size of current employer</i>	
Micro (> 5 employees)	27 (3.5)
Small (6 to 50 employees)	123 (15.7)
Medium (51 to 500 employees)	166 (21.2)
Large (< 500 employees)	439 (56.1)
Unknown / not specified	27 (3.5)
<b>TOTAL</b>	<b>782 (100)</b>
<i>Source: Authors' calculations</i>	

Table 3: Current worker location by experience at Blackberry

Location	<1 year	1 to 3 years	3 to 5 years	5 to 10 years	10+ years	Unknown	Total
Waterloo	69 (47.3%)	125 (49.4%)	73 (57.5%)	102 (59.6%)	38 (69.1%)	20 (66.7%)	<b>427 (54.6%)</b>
Toronto	26 (17.8%)	41 (16.2%)	16 (12.6%)	20 (11.7%)	5 (9.1%)	3 (10%)	<b>111 (14.2%)</b>
Rest of Canada	14 (9.6%)	45 (17.8%)	24 (18.9%)	19 (11.1%)	5 (9.1%)	4 (13.3%)	<b>111 (14.2%)</b>
Silicon Valley	23 (15.8%)	19 (7.5%)	8 (6.3%)	13 (7.6%)	3 (5.5%)	3 (10%)	<b>69 (8.8%)</b>
Seattle	2 (1.4%)	4 (1.6%)	3 (2.4%)	1 (0.6%)	--	--	<b>10 (1.3%)</b>
Rest of United States	11 (7.5%)	18 (7.1%)	3 (2.4%)	13 (7.6%)	4 (7.3%)	--	<b>49 (6.3%)</b>
Rest of World	--	1 (0.4%)	--	3 (1.8%)	--	--	<b>4 (0.5%)</b>
Unknown	1 (0.7%)	--	--	--	--	--	<b>1 (0.1%)</b>
<b>Total</b>	<b>146 (100%)</b>	<b>253 (100%)</b>	<b>127 (100%)</b>	<b>171 (100%)</b>	<b>55 (100%)</b>	<b>30 (100%)</b>	<b>782 (100%)</b>

*Source: authors' calculations*

Table 4: Ecosystem Membership by Blackberry Experience

Years of experience	Entrepreneurial ecosystem	Elsewhere in the economy	Total
Co-op term	26 (17.8%)	120 (82.2%)	146
New to firm (< 2 years)	55 (21.7%)	198 (78.3%)	253
Some firm experience (2 to 5 years)	27 (21.3%)	100 (78.7%)	127
Established in firm (5 to 10 years)	55 (32.2%)	116 (67.8%)	171
Embedded in firm (> 10 years)	23 (41.8%)	32 (58.2%)	55
Unknown / not specified	6 (20.0%)	24 (80.0%)	30
<b>TOTAL</b>	<b>192 (24.6%)</b>	<b>590 (75.4%)</b>	<b>792</b>

*Source: authors' calculations*

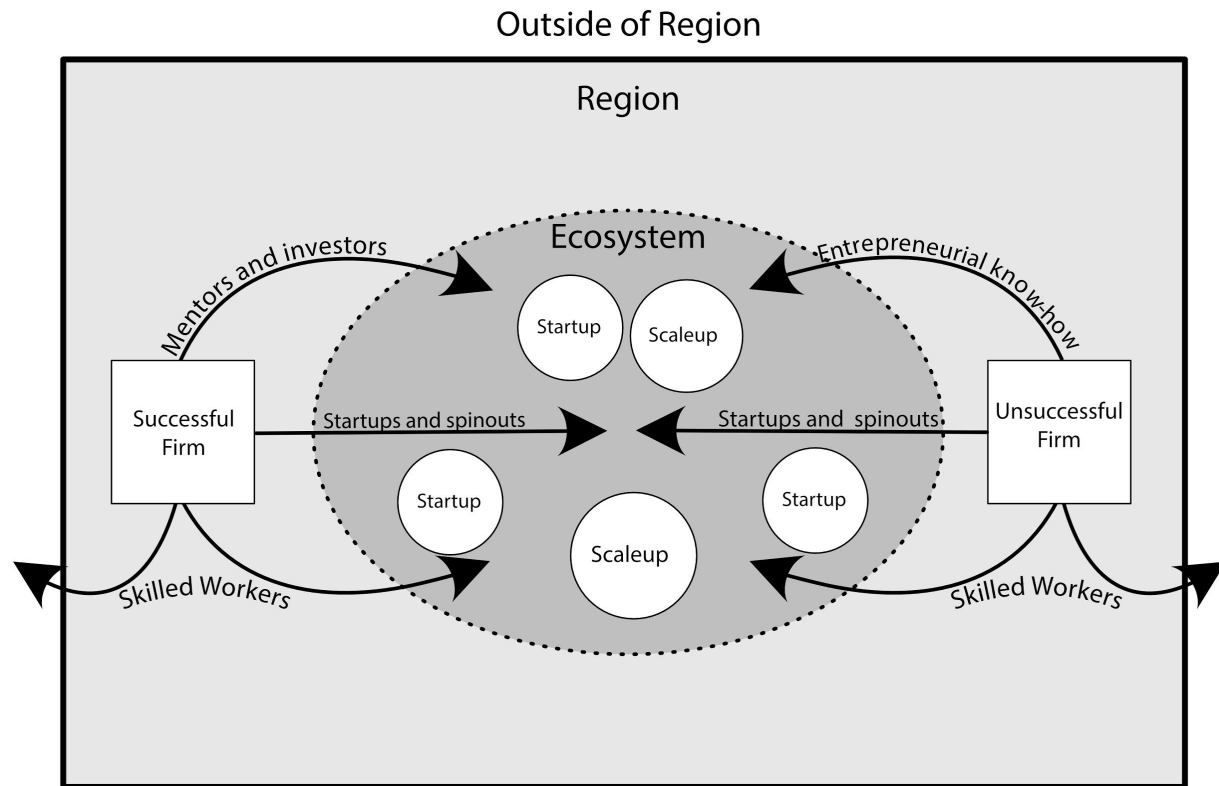


Figure 1: Recycling within entrepreneurial ecosystems  
*Source: Authors' conceptualization based on the literature*

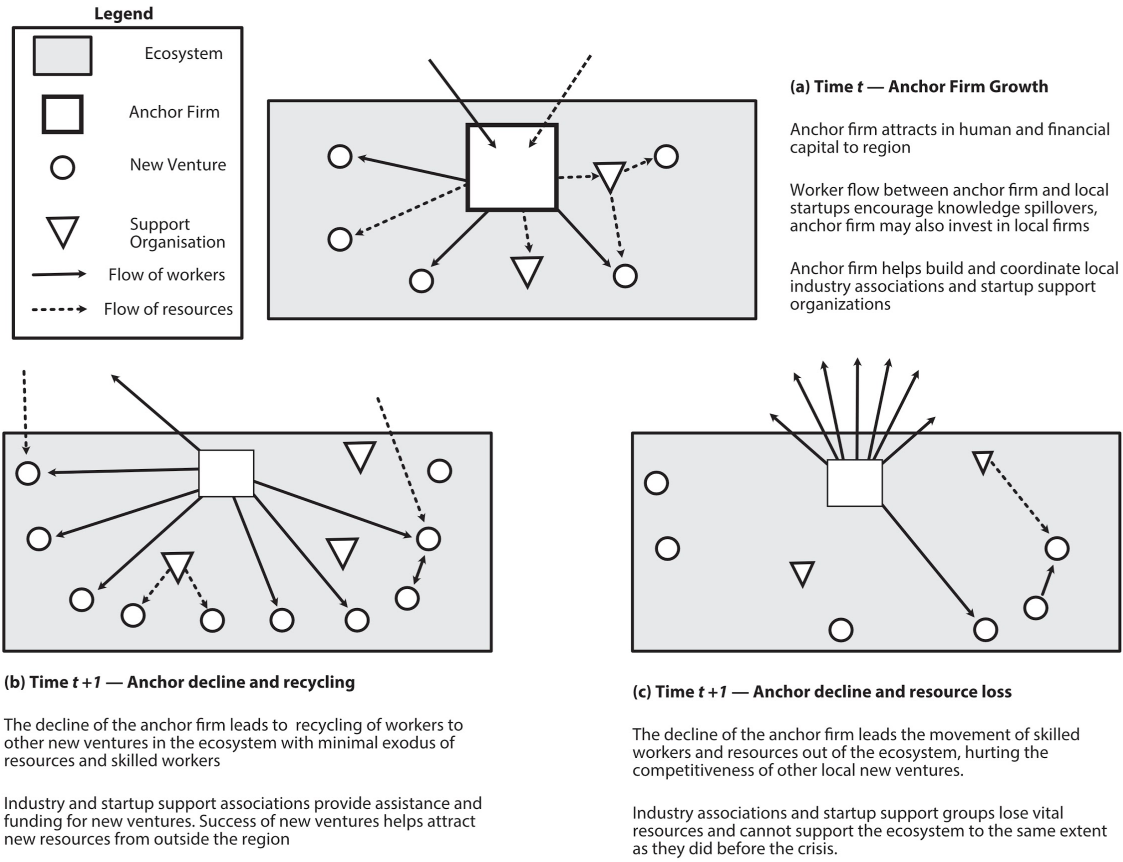


Figure 2: Entrepreneurial ecosystem pathways after anchor collapse

Source: Authors' conceptualization based on the literature

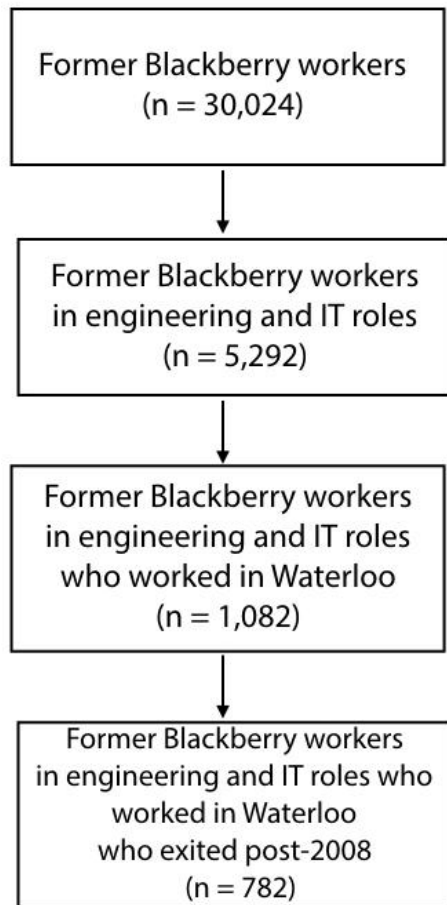


Figure 3: Data selection process  
*Source: Authors' calculations.*



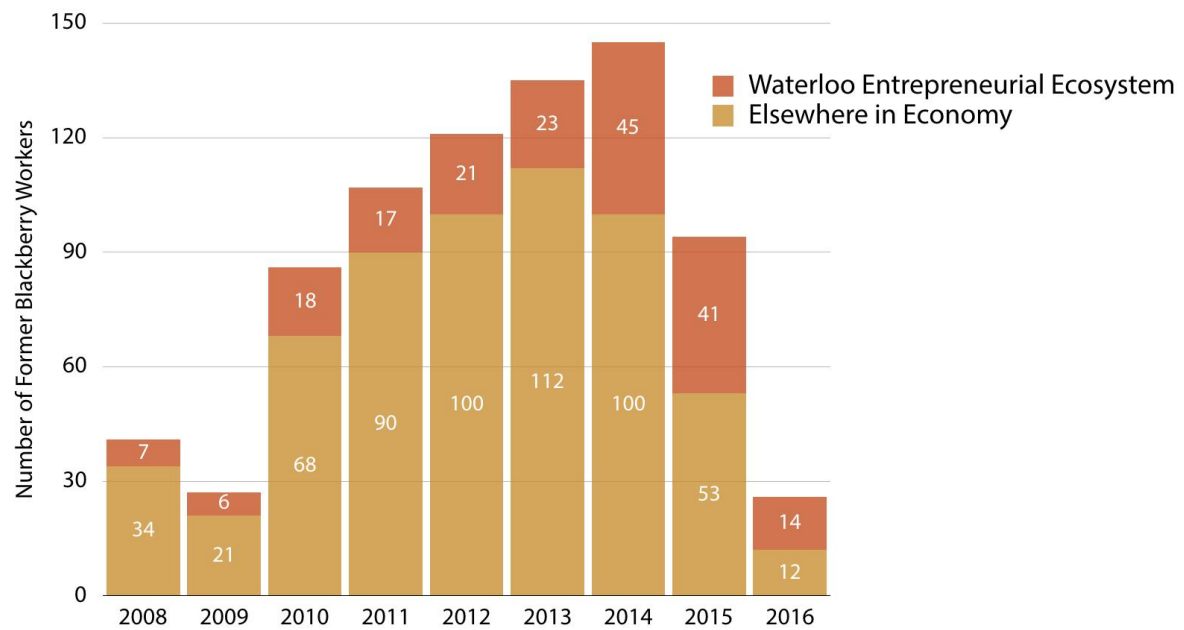


Figure 4: Last year of employment at BlackBerry

*Source: Authors' calculations*

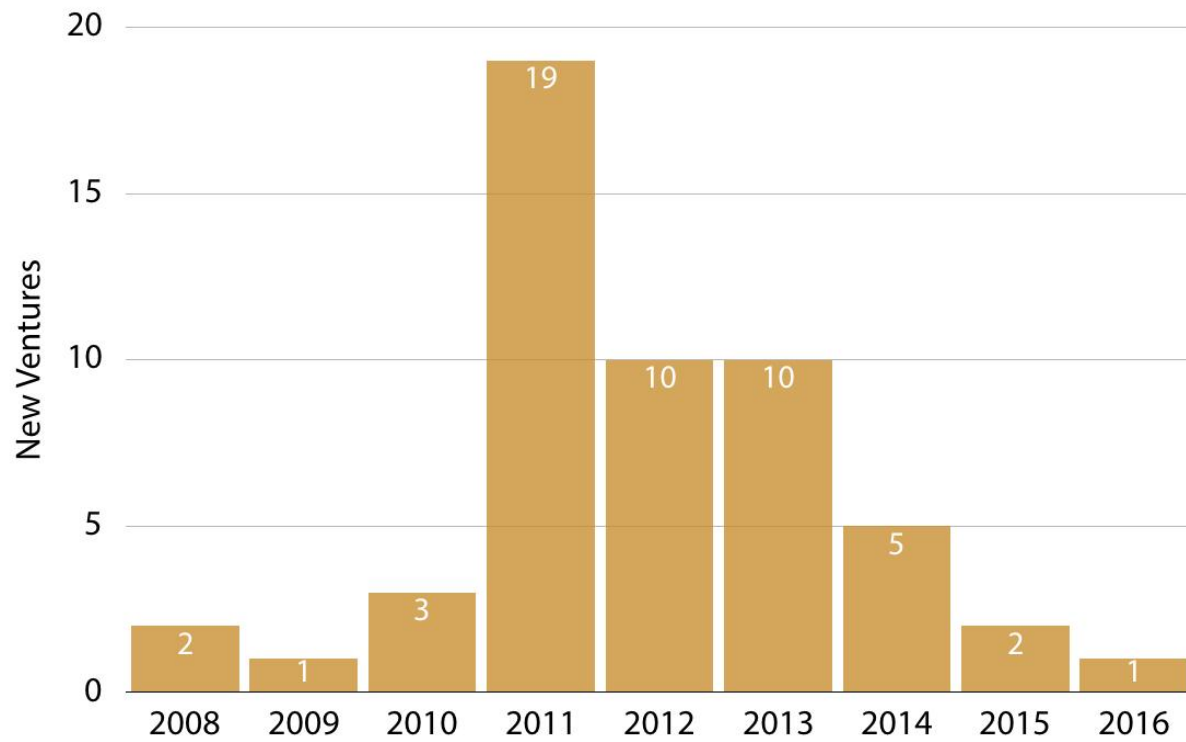


Figure 5: Location of new ventures by year of last employment at BlackBerry

*Source: Authors' calculations*

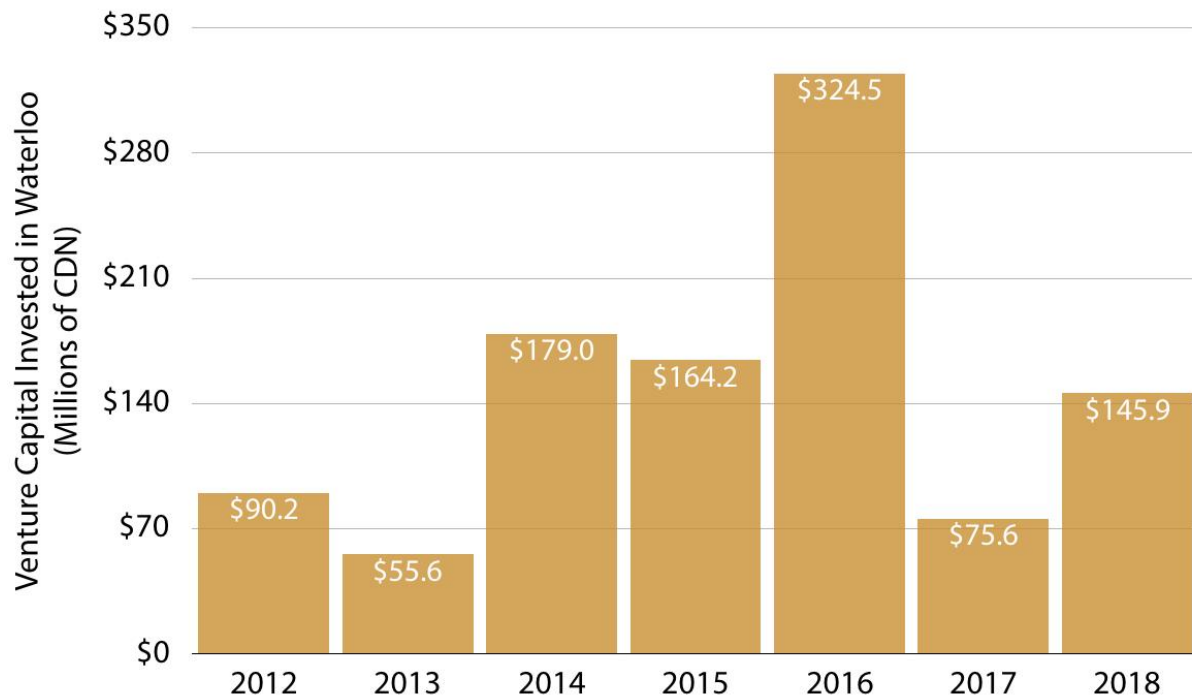


Figure 6: Venture capital in the Waterloo region, 2012-2018

Source: Innovation Policy Lab Database; Authors' calculations